

EXPERIMENTAL INVESTIGATION ON PERFORMANCE OF CAMPRO  
ENGINE WHEN MODIFY EXHAUST GAS EXTRACTOR

MOHD MUSTAFFA HAFIZ BIN KHALIL

2005371019

A thesis submitted in partial fulfillment of the requirement for award of Bachelor of Engineering  
(Hons.) in Mechanical Engineering.

FACULTY MECHANICAL ENGINEERING  
UNIVERSITITEKNOLOGI MARA (UiTM)

MAY 2009

## ACKNOWLEDGEMENT

First and foremost, Alhamdulillah and thanks to Allah S.W.T for the completion of this thesis. I am eternally grateful for the support and encouragement from my family. Since the day I entered higher education institution, my family has always inspired and motivates me beyond mere academic mediocrity. During the past year and the half, the support has continued and encourages me to more hardworking and tough in completing my project. The satisfaction of completion this project would have been meaningless without having my family support throughout the entire process.

I am also indebt to Mr. Idris Bin Saad as my project advisor for his guidance into the finer aspects of making this thesis finish successfully. Furthermore to some of my fellow friends who helped and support me as well not only trusting in accomplishing this project. Moreover, this research would not have been possible without the helped from Mr. Aminuddin Bin Zulkifli on the Dynamometer Machine application which he gives insights into the finer aspects of Dynamometer.

## ABSTRACT

Automotive exhaust system is a device to carry out gases from an engine then discharge it to atmospheres. It is consist of exhaust gas extractor, exhaust pipe, catalytic converter, tail pipe and muffler. The main'function of design the exhaust gas extractor is to decrease the flow resistance (also know as back pressure), and to increase the volumetric efficiency of an engine, resulting in a gain in power output. By using Satria Neo 1.6 Campro engine, the comparison of torque and horse power between standard exhaust gas extractor compared to 4-2-1 and 4-1 was obtained. Function of using 4-2-1 and 4-1 are to compare the reducing backpressure of the exhaust system and the increasing of torque and horse power with the standard exhaust gas extractor. This project is used Dynapack Chasis Dynamometer machine to generate the result of torque and horse power between standard exhaust system, 4-2-1 and 4-1. By using this Dynapack Chasis Dynamometer machine, the graph of torque and horse power of the engine are automatically plotted when finish the experiment. This machine also provides all the data needed from this investigation after finish the experiment.

## TABLE OF CONTENTS

ACKNOWLEDGEMENT	i
ABSTRACT	ii
TABLE OF CONTENTS	iii- v
LIST OF FIGURES	vi-vii
LIST OF TABLES	vii
CHAPTER 1: INTRODUCTION	1
1.1 Overview	2
1.1.1 Campro Engine	2
1.1.2 Exhaust System	2
1.1.3 Exhaust Gas Extractor	3
1.1.4 Exhaust Pipe	4
1.1.5 Catalytic Converter	5
1.1.6 Exhaust Muffler	6
1.1.7 Tail Pipe	7
1.2 Objective of the Project	8
1.3 Significance of Project	8
1.4 Scope of Project	8
1.5 Project Methodology	9
CHAPTER 2: LITERATURE REVIEW	10
2.1 Design of a heat exchanger to reduce the exhaust temperature in a spark-ignition engine	10
2.2 Experimental Study on exhaust emission from a multi-cylinder DME engine operating with EGR and oxidation catalyst	11

2.3	Design of exhaust manifold to improve transient performance of a high-speed turbocharged diesel engine	11
2.4	Optical system for CO & NO gas detection in the exhaust manifold of combustion engines	12
2.5	The influence of H <sub>2</sub> & CO on diesel engine combustion characteristics, exhaust gas emissions, and after treatment selective catalytic NO <sub>x</sub> reduction	12
2.6	Exhaust and emission control system	13
2.7	Development of Exhaust Manifold	13
2.8	Exhaust Gas Extractor Pressure	14
CHAPTER 3: DYNAPACK CHASIS DYNANOMEFER MACHINE		15
CHAPTER 4: RESULT AND DISCUSSION		22
4.0	Introduction	22
4.1	Axle Power	23
4.1.1	Axle power data for standard Exhaust Gas Extractor	23
4.1.2	Axle power data for 4-1 Exhaust Gas Extractor	25
4.1.3	Axle power data for 4-2-1 Exhaust Gas Extractor	27
4.1.4	Comparison Graph for Axle Power	29
4.2	Axle Torque	30
4.2.1	Axle Torque data for standard Exhaust Gas Extractor	30
4.2.2	Axle Torque data for 4-1 Exhaust Gas Extractor	32
4.2.3	Axle Torque data for 4-2-1 Exhaust Gas Extractor	34
4.2.4	Comparison Graph for Axle Torque	36
4.3	Tractive Effort	37
4.3.1	Tractive Effort data for standard Exhaust Gas Extractor	37
4.3.2	Tractive Effort data for 4-1 Exhaust Gas Extractor	39
4.3.3	Tractive Effort data for 4-2-1 Exhaust Gas Extractor	41
4.3.4	Comparison Graph for Tractive Effort	43